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# A View of Command, Control, Communications and Computer Architectures at the Dawn of Network Centric Warfare

By Kevin J. Cogan

***The best way to predict the future is to invent it.***
—Alan Kay, American Computer Scientist

***The very essence of leadership is that you have a vision. You can't blow an uncertain trumpet.***
—Rev. Theodore M. Hesburgh
President Emeritus, University of Notre Dame

## BACKGROUND

In March 2004, the U.S. Army War College (USAWC) in cooperation with the Office of the Secretary of Defense (OSD) Office of Force Transformation (OFT) initiated a study focusing on the U.S. Army V Corps' and 3rd Infantry Division's major combat operations during Operation Iraqi Freedom (OIF). This study, entitled "Network Centric Warfare Case Study: U.S. V Corps and 3rd Infantry Division (Mechanized) during Operation Iraqi Freedom Combat Operations (March-April 2003)" is one of several case studies commissioned by OFT to determine the military's ability to conduct operations in accordance with network centric warfare (NCW) concepts. The March 2004 study culminated in the first of three volumes entitled "Operations." In March 2006, the study was expanded to include both the communications architecture for OIF combat operations (Volume II) as well as NCW insights (Volume III). This issue paper focuses on Volume II, which analyzes command, control, communications, and computer architectures to ascertain the potential strategic and operational implications of net-centric operations from an acquisition perspective.

Volume II critically analyzes the history of communications architecture acquisition before OIF and the inadequacy of current acquisition cycle times to keep pace with the rapid advances in technology. It provides the reader with three insights: (1) a historical view of advances in technology which ultimately enabled a computer communications network; (2) an encapsulation of the Army command, control, communications, and computer (C4) architecture for two specific timeframes of Operation Iraqi Freedom (OIF) referred to as pre-OIF and OIF-1; and (3) examines future communications programs that are underway for next generation C4 architectures with respect to the ability of the Department of Defense (DoD) acquisition process to keep pace with the rapid advances in technology.

Change, in almost every facet of 21st century technology, is demonstrably accelerating exponentially, that is, the rate of change itself is increasing. This function can be portrayed as a curve (see Figure 1 on the next page). Specific observations conclude that change should be anticipated and, at some point along the curve, a paradigm shift will occur to initiate the start of a new S-curve. Paradigm shifts are difficult to predict and are prone to spontaneous eruption as was true in the case of the World Wide Web. Accordingly, it was virtually impossible to anticipate the explosive demand for battlefield video and data which would render existing tactical communication systems obsolete and restrict the tactical commanders' ability to command and control forces on

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highly mobile battlefield. The OIF-1 communications architecture as compared to the pre-OIF architecture, both outlined in Volume II, serve to underscore the predicament that exists when communication architectures fail to keep pace with rapid technological advances. Despite valiant efforts to bridge this gap in the span of just a few months before the beginning of OIF combat operations, nothing could provide the total bandwidth needed, the collaboration tools desired, nor the ability to command and control on the move which are now deemed essential for the modern battlefield. This war revealed that a communications paradigm shift occurred before the outbreak of hostilities and it recognized that the next generation communication architectures were yet far out on the horizon. Thus, this volume peers at the programs on that horizon at the dawn of NCW and then points to the urgent need to reinvent the acquisition process to procure them sooner.

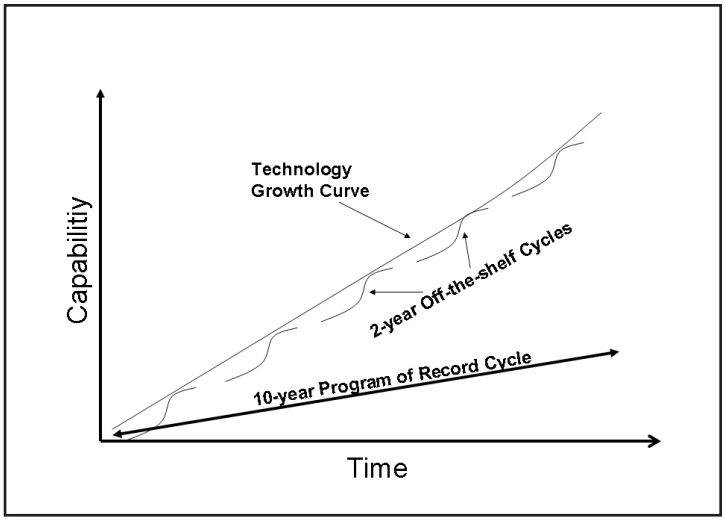

Figure 1: New technology (S-curve) comes faster than the acquisition cycle can respond

The problems were further exacerbated when Congress halted the Joint Network Node (Figure 2) solution for OIF until it evaluates a report from the Secretary of the Army they were scheduled to receive on 15 March 2007. Additionally, the Warfighter Information Network-Tactical (WIN-T), already in its eighth year since its operational requirement, was delayed an additional five years until 2013 before its initial operational capability (IOC). Each chapter of Volume II highlights an integral part of the solution to the problem at hand: (1) invention, (2) simplicity, (3) the Army you want, (4) innovation, (5) acquisition cycle times, (6) delays, (7) vision, and (8) cleverness. Volume II is an appeal to readers to invent the future rather than merely attempting to predict it.

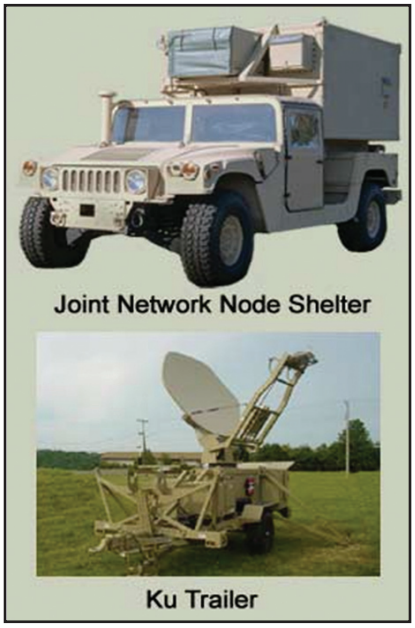

Figure 2: Joint Network Node

## INSIGHT 1

Mobile Subscriber Equipment (MSE) was inadequate for the Gulf War and obsolete for OIF. The historical view of communication architectures depicts a slow, methodical, and relatively stable architecture throughout the 20th century up until the end of the Cold War. Computers are not actually embedded in communications equipment until the advent of MSE just prior to the Persian Gulf War. The Internet was in fledgling use and the World Wide Web had yet to be invented. The United States prosecuted the Persian Gulf War swiftly and over great distances. This would be repeated in OIF, the setting for this study. "Accelerated expectations" is a term used to represent the gap between what the acquisition system could provide over lengthy procurement cycles and what commercial equipment could provide for both garrison and civilian use. The demand for real-time, ubiquitous, on the move communications exceeded the ability of military communication architectures to keep pace with the acceleration of technological innovation. The current acquisition process for programs of record cannot adequately shorten the procurement cycle to accommodate the accelerated pace of new technology. Consequently, MSE (the Army communications we had on hand) was inadequate for the Gulf War and obsolete for OIF.

## INSIGHT 2

The U.S. Army was ill-prepared to launch OIF in March 2003 from a tactical communications perspective. Unlike WWII and to some extent even the Persian Gulf War, commanders were not going to constrain themselves by the limitations of the organic communications systems in the signal battalions of the division and corps. OIF-1

units in V Corps provided an introspective look at the ability to communicate in an unprecedented pursuit of enemy forces in terms of speed and distance. Analysis from as early as 1998 indicated that active duty U.S. divisions could not provide the requisite volume of communications with organic equipment. Video and data requirements put great pressure on the limited bandwidth available, while voice requirements remained relatively flat. In hindsight, this is not surprising since the Internet was coming of age in 1995. Even five years before OIF, experimentation by the 4th Infantry Division at Fort Hood TX included the utilization of video and data information tools that overmatched the bandwidth capability of MSE. Consequently, the twelve month period prior to OIF-1 was a scramble to augment units with a system that could exploit the non-line-of-site communications demands of the war in Iraq. Units were hastily equipped with a technology soon to be dubbed Blue Force Tracker (BFT). BFT gave maneuver units a near-real-time sense of the position of friendly forces and some minimal and ephemeral text capability. Volumes I and III of the case study depict the enhancements that BFT provided and reliance that commanders placed on this new, yet unproven, capability. Tactical satellite communications also greatly extended the range of crucial communications and were an integral component of BFT. However, the distribution of BFT and satellite radios was sparse. General William Wallace, V Corps Commander, was equipped with a Command and Control Vehicle (C2V) which in some sense was a foreshadowing of what the future holds in store for mounted command and control on the move envisioned for C4 architectures over the next decade.

## INSIGHT 3

A new vision and acquisition process must be found to radically improve procurement cycle times. WIN-T and JNN are developing communications architectures that utilize two radically different procurement perspectives. WIN-T predates OIF by five years and is formally a "program of record" which signifies that it has its origins in the normal acquisition process with a required operational concept (ROC) and a board select program manager (PM). Programs of record adhere stringently to the life cycle management process which includes formal milestone reviews and pre-operational testing. WIN-T was conceived to be a ten-year program with an IOC capability planned for 2008. However, it could provide nothing when OIF-1 was fought in 2003 or in any of the ensuing years to the present time.

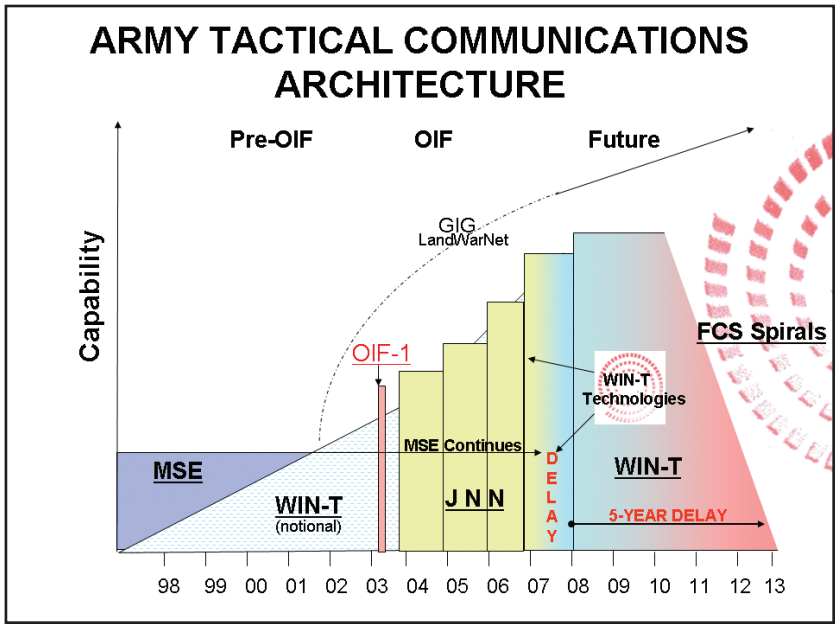


Figure 3: An integrated view of major tactical C4 architectures

"Going to war with the Army you have," stated by Secretary of Defense Rumsfeld, is a valid statement with regard to long procurement cycle times. In the summer of 2006, the WIN-T IOC was programmatically delayed until 2013 (see Figure 3). This situation represents a twenty-three year delay (1990–2013) to field a C4 architecture sufficient to support the way the U.S. Army wants to maneuver in battle. Alternatively, the JNN was conceived as an *in situ* solution for U.S. forces in the Iraqi theater near the end of major combat operations in OIF-1. JNN was not a program of record then and the appointment of a PM was informal. It utilized "state of the science" commercial off-the-shelf networking equipment configured in a vehicular mounted tactical communications shelter. And although JNN could not yet provide communications on the move, it did greatly expand battlefield networking capability. JNN made use of wartime supplemental funding and rapid configuration. It fell short of all the formal architectural framework requirements set forth by the DoD, but it resolved many of the commanders' accelerated expectations. JNN is a post-OIF-1 solution for ongoing operations that would never have been available had it initially been a program of record. It is a testimony of what can be accomplished cost effectively and in short order to meet warfighting requirements. Ironically, after its rapid response and success, JNN has been re-designated a program of record and will have to endure future delays inherent in the formal acquisition process. Worse, Senate Bill S.2766 entwines JNN with WIN-T which will add to fielding delays.

## CONCLUSION

It is crucial for 21st century C4 architectures to have shorter cycle times to capitalize on current technology. This stems from two issues: (1) technology cycle times are no more than two years long at best as new technologies emerge and replace current technologies; (2) potential and present day adversaries have no boundary conditions on procuring new technologies for immediate use as quickly as they are available. Consequently, it is possible and even probable that five two-year technology cycle times are nested in one 10-year program of record cycle time. If war erupts, it is likely that the acquisition process cannot deliver current programs at the onset of hostilities, and yet the adversary does not confront this dilemma. The JNN vs. WIN-T comparisons in this study compare two disparate acquisition strategies. This is not a new acquisition problem. This problem is getting worse as the acceleration of technology shrinks cycle times even more. There has been no significant change to acquisition law and directives to match the expectation and demand for rapid technology insertion. The pace of new technology spiral developments envisioned for the Future Force will soon overwhelm the ability to acquire new C4 systems using the 20th century acquisition tools currently mandated. Tactical C4 architectures have to be acquired as if the Army is always at war – because in many respects, our Nation is always at war, or preparing for war.

Consequently, this case study cites four needs to overcome the problem: (1) recognize that there is a need for a more rapid C4 development program; (2) reinvent the acquisition and force management processes for C4 programs; (3) leverage the Navy Open Architecture Study for Army C4; and (4) establish migration plans for all C4 architectures and adhere to the DoD Architecture Framework and the Global Information Grid.

There is no closure to the view of communications architecture set forth here. It can only be said that, at the dawn of NCW, the field is wide open for inventing the future. It is insufficient to develop C4 architectures for their own sake and at a pace which waxes and wanes with the vagaries of political and budgetary climates. Rather, it is imperative that capability cycle times match or exceed that of any adversarial threat. In that way, going to war with the Army you have will be going to war with the Army you want to have. Volume II is for readers who have ideas and a desire to invent the future state of NCW. Their inventions will predict the C4 architectures of tomorrow.

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*Volume II of the case study and other Center for Strategic Leadership publications may be found on the USAWC/CSL web site at: http://www.carlisle.army.mil/usacsl/Studies.asp.*

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